Foreword

Improving the Precision of Neonatal Neuroimaging

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Consulting Editor

Like in many other areas of medicine, much has changed in the field of neonatal neuroimaging. In caring for a neurologically impaired newborn, the clinician relies heavily on imaging techniques to guide clinical care and prediction of long-term outcomes. Diagnostic modalities include ultrasound, magnetic resonance imaging (MRI), electroencephalogram (EEG), near-infrared spectroscopy, and more. Each is useful in specific circumstances; however, the future lies in combining these techniques into clinical algorithms derived from large databases and artificial intelligence (AI) to refine the diagnostic and predictive value.[1] Such approaches form the basis of precision medicine and can go a long way in helping families make key decisions when confronted with challenging diagnoses, such as hypoxic ischemic encephalopathy, neonatal stroke, and intracranial hemorrhage. After the critical initial period is over, questions invariably shift from survival to anxiety about longer-term sequelae, such as cerebral palsy and cognitive impairment. Our greatest hope lies in using machine learning and AI to improve the ability of these tests to more accurately predict longer-term outcomes by harnessing the extensive data on all available diagnostic approaches (**Fig. 1**).[1]

Indeed, many neonatal intensive care units assign multidisciplinary teams that are dedicated to brain-oriented care for neonates admitted to their specialized neuro-intensive care units. In addition to their focus on brain protection, neonates cared for in these dedicated areas have easier access to on-site and advanced neurologic assessments, such as MRIs, EEGs, general movement assessments, and diagnostic scales, such as the Hammersmith Infant Neurological Examination. These techniques can predict long-term sequelae, such as cerebral palsy, with remarkable accuracy even in very young infants.[2]

MRI has also become an indispensable tool for imaging fetal congenital malformations. Advanced MRI techniques and data can provide images with stunning clarity in disorders like spina bifida (**Fig. 2**).[3] These approaches can better predict severity

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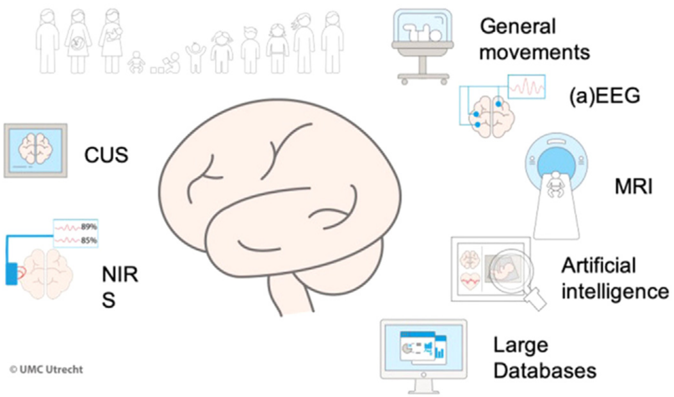

Fig. 1. Precision medicine for brain-oriented care. CUS, cranial ultrasound; MRS, magnetic resonance spectroscopy. (*From* Tataranno ML, Vijlbrief DC, Dudink J, Benders MJNL. Precision Medicine in Neonates: A Tailored Approach to Neonatal Brain Injury. Front Pediatr. 2021 May 19;9:634092.)

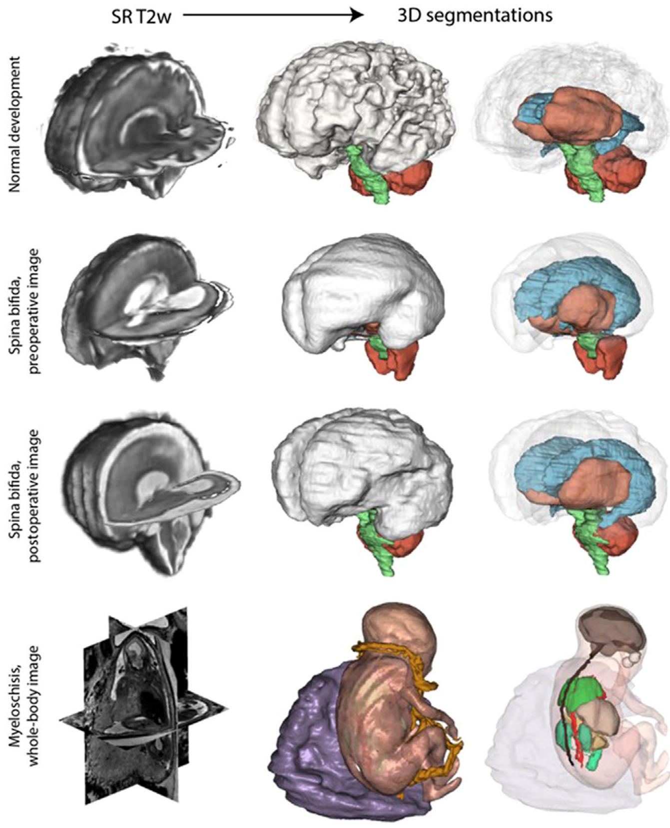

Fig. 2. Superresolution (SR) reconstruction of fetal MRI. For each case (normal development, preoperative, and postoperative images of spina bifida fetus undergoing fetal surgery and myeloschisis), the SR T2-weighted MRI (*left images*) and 2 surface reconstructions that were based on the segmentation of the reconstructed image (*right images*) are demonstrated. 3D, 3-dimensional; T2w, T2-weighted. (From Jakab A, Payette K, Mazzone L, Schauer S, Muller CO, Kottke R, Ochsenbein-Kölble N, Tuura R, Moehrlen U, Meuli M. Emerging magnetic resonance imaging techniques in open spina bifida in utero. Eur Radiol Exp. 2021 Jun 17;5(1):23.)

of the lesion and known complications, such as hydrocephalus; they are also better at predicting motor function later in life.

In this issue of the *Clinics in Perinatology*, Drs Kanekar and Milla have brought together an impressive lineup of authors and topics that address critical issues in neuroimaging. As always, I am grateful to the publishing staff at Elsevier, including Kerry Holland and Karen Justine Solomon, for their support in allowing us to bring a broad range of clinically relevant topics to you.

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